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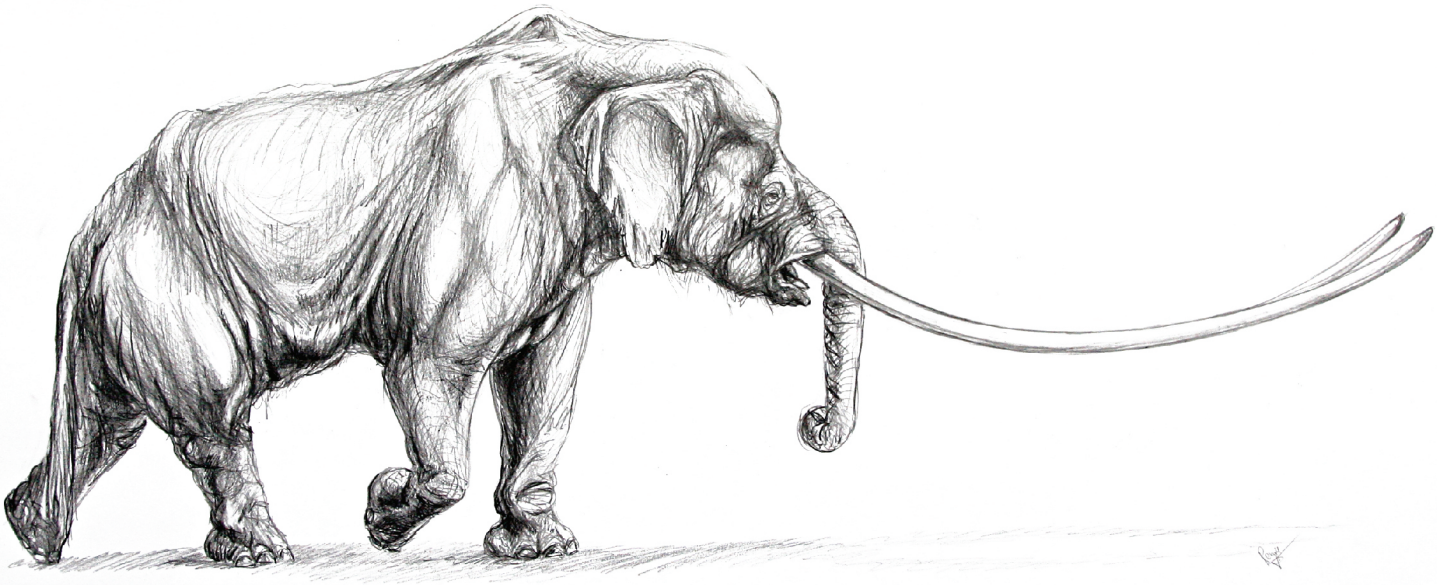

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ABSTRACT BOOK

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From the Charkadio cave excavation, to a full 3D reconstruction of an extinct elephant

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Without doubt Greece has a unique natural and cultural heritage. Over the years paleontological excavations have contributed to this rich heritage. Charkadio cave, on the Island of Tilos, is one of the richest fossiliferous sites with remains of the last European elephant, *Elephas tiliensis*. These dwarf elephants were the last to inhabit a Mediterranean Island. A highly innovating project was set up under the Research Funding Program THALES (MIS380135) with the unique goal to fully reconstruct an anatomically complete *E. tiliensis* skeleton that will be presented to the wider public, taking advantage of the breakthroughs in mechanical engineering and then utilizing them in a paleontological process.

An extensive *E. tiliensis* fossil collection is deposited at the Museum of Palaeontology and Geology of the National and Kapodistrian University of Athens. The identified skeletal elements were prepared by highly skilled laboratory personnel, and a large number of specimens, selected according to a series of biometric criteria, were sorted in order to be digitized and represented in a virtual prototyping environment.

The specimens were scanned with a computed tomographic scanner. The sample was carefully packed into cardboard boxes, separated with the use of appropriate supporting material that would not interfere or produced noise to Computed Tomographies. In addition, different skeletal elements were sorted out to be digitized using a state-of-the-art Laser Scanning Measuring Arm. The combination of these two methodologies resulted in an extensive number of raw digital data (DICOM files, Point Clouds). Each data set was then inserted into several commercial 3D manipulation software programs (Mimics, Geomagic, Solidworks). Each bone structure is then broken down to its primary data construct and the main dimensions are measured in the 3D model, based on the body related coordinated system. Using Solidworks and Geomagic, the aforementioned data are then implemented into parts of each bone. Based on these 3D files, the measured dimensions, ontogenic observations, allometry and taphonomy the paleontologists are able to locate areas of interest and create the necessary alternations on the virtual parts. Furthermore statistical analyses of selected measurements are combined in order to formulate mathematical equations that will estimate missing values of measurements in the sample. The completion of the above methodology will lead to the construction of an accurate *E. tiliensis* skeleton printed three-dimensionally. The initial goal is the creation of a virtual model for each bone, in order to be tested and assembled as a representation of the skeletal structure of an extinct dwarf elephant. The next step in this process would be for the bone structure to be "printed"/manufactured with the use of state-of-the-art Rapid Prototyping technics, in order to pass from the virtual prototyping phase to the actual prototype phase.

Currently, all stages of the project are ongoing, and partial results are promising, especially those focusing on the mathematical aspect that will provide a skeletal element resizing guide. The first digitized specimens through the use of Rapid Prototyping Technologies are printed by both Laminated Object Manufacturing (LOM) and Fused Deposition Modeling (FDM) procedures that will be used to construct the complete skeletal reconstruction.

The research teams involved are conducting an interdisciplinary study in the field of vertebrate paleontology in Greece with partial results revealing significant findings for the biometry of *E. tiliensis*. The three dimensional reconstruction of the anatomical correct skeleton will be housed in a Museum situated next to the excavation site of Charkadio cave.

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